

REMARKS

Claims 14 - 17 are withdrawn from examination. Claims 19 - 37 are presented for examination. Claims 1-13, and 18-37 are pending in the application.

Restriction Requirement

The Examiner is thanked for the telephone call to the undersigned, requesting that a provisional election be made. Applicants affirm the provisional election of Group 1, drawn to a method for bonding materials, without traverse.

Information Disclosure Statement

The Examiner is thanked for initialling and returning the PTO/SB/08B submitted on July 7, 2004.

A second Information Disclosure Statement and PTO/SB/08B is submitted concurrently herewith with documents for the Examiner's consideration.

Substitute Specification

Kindly find attached a marked up and clean copy of a Substitute Specification. Entry of the Substitute Specification is requested. Support for the appended paragraphs in the Substitute Specification is found in the provisional application filed on March 7, 2003.

Drawings

A review of the pending application found that the current FIG. 5 would better illustrate the fixture for holding the materials to be bonded if minor modifications were made to the figure. Kindly find enclosed a replacement sheet for FIG. 5. Support for the replacement FIG. 5 is found in Figure 4, page 4 of the provisional patent application.

Application No. 10/672,271
Attorney's Docket No. N.C. 83,977

AMENDMENTS TO THE DRAWINGS

Kindly replace Figure 5 with the revised Figure 5 enclosed as an attachment hereto.

Kindly enter the enclosed new drawing Figure 6 enclosed as an attachment hereto.

A new drawing figure, FIG. 6, is enclosed. Support for this drawing figure is found at Figure 6, page 6 of the provisional application.

Rejection under 35 U.S.C. § 112, second paragraph

Page 3 of the Office Action set forth a rejection of Claims 1-13 and 18 as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention.

Kindly refer to the first paragraph of page 12 and 26 of the enclosed Substitute Specification, which allows one of ordinary skill in the art to ascertain what is meant by “rapidly cooling”.

Claim 13 has been amended to address the antecedent basis issue discussed at page 4 of the Office Action.

Page 4 of the Office Action also indicated that it was not clear what is meant by “low temperature fixtures” in Claim 4. Attention is drawn to pages 21 and 22 of the Substitute Specification and column 1, page 4 of the provisional application filed on March 7, 2003. In microwave cavity systems, superalloys or high temperature ceramics were employed. In contrast, in the microwave beam and rapid heating of the method set forth in the pending claims, low temperature fixtures can be used. As described in the Substitute Specification and col. 1 of page 4 of the provisional application “The most important byproduct of the beam heating, however, is the freedom to use almost any material for fixturing - for providing alignment of pieces being joined and for applying pressure to the joints.” Examples set forth in the

specification include steel and BN ceramic, although it will be obvious to those skilled in the art that other materials may be used within the scope of the term “low temperature fixture”.

Rejections under 35 U.S.C. § 103(a)

Pages 5-7 of the Office Action set forth a rejection of independent Claims 1 and 18, and dependent Claims 2-7 and 9-13 under 35 U.S.C. § 103(a) as being obvious under 35 U.S.C. § 103(a) based on the disclosures of U.S. Patent No. 6,054,700 to Rokhvarger et al., U.S. Patent No. 6,532,769 to Meinhardt et al., and U.S. Patent No. 4,606,748 to Blake et al. Applicants respectfully request reconsideration of this rejection.

Claim 1 is directed to a method for bonding materials using localized microwave energy including applying a thin coating of a joining material to each surface of the base materials being joined, disposing each said base material such that the surface of the base materials being joined are in contact with the desired alignment and pressure necessary for maintaining the contact between the materials and creating the desired component assembly, *heating said joint area with a microwave beam* applied to the surfaces of the base material being joined to achieve localized heating of the joint area, maintaining said joint area at said reactive temperature to allow for the interdiffusion of the base and joining materials and formation of a homogenous joint region, rapidly cooling said joint area to a recrystallization temperature and maintaining said joint area at the recrystallization temperature for a predetermined period, and slowly cooling said joint area to room temperature. The heating with a microwave beam includes heating said joint area to an initial joining temperature, wherein said joining material softens and fills physical discontinuities between the surfaces of the base materials being joined, and rapidly heating said joint area to the

reactive temperature of the joining material and the base materials.

Rokhvarger et al., Blake et al., and Meinhardt et al. all fail to disclose at least the feature of “heating said joint area with a microwave beam applied to the surfaces of the base material being joined to achieve localized heating of the joint area”.

Rokhvarger et al. employs a microwave ring furnace for heating. There is no disclosure of a microwave *beam* providing localized heating of the joint area. Instead, diffuse microwave energy is applied to the entire surface that is exposed within the ring jacket 31. Rokhvarger et al. discloses at column 7, lines 28-35 that “In order to limit high temperature heating to the joint area only, the MWTS furnace is preferably constructed as a ring jacket 31 that surrounds the container body at the joint area.” Thus, it is clear that in Rokhvarger et al., any localization of the microwave energy to the joint area is caused by the ring jacket, rather than by the beam characteristics of the microwave beam, as in Claim 1.

Neither Meinhardt et al. nor Blake et al. cure this deficiency of Rokhvarger et al. Therefore, the hypothetical combination of Rokhvarger et al., Meinhardt et al., and Blake et al. would not result in a method having all the features of Claim 1. Accordingly, withdrawal of the rejection of Claim 1 under 35 U.S.C. § 103(a) is respectfully requested.

Dependent Claims 2-13 are believed to be allowable over the cited references for at least the same reason that Claim 1 is allowable. Nonetheless, a few comments regarding several of the dependent claims are provided.

Claim 13 recites that the low temperature fixtures do not reach temperatures above 100 degree Centigrade. The Office Action points to the insulation surrounding the joint of

Rokhvarger et al. as corresponding to the claimed low temperature fixtures, however, there is no disclosure in Rokhvarger et al. that the insulation 30 does not reach temperatures above 100 degrees Centigrade.

Independent Claim 18 has been amended to recite that heating is accomplished with a beam of millimeter wave energy. Several advantages of using millimeter wave energy are described at pages 9 and 10 of the specification. Rokhvarger et al., Meinhardt et al., and Blake et al. each fail to disclose this feature. Accordingly, Claim 18 is believed to be allowable over the hypothetical combination of these references.

Claims 19 and 20 depend from Claim 18, are allowable for at least the same reasons that Claim 18 is allowable, and set forth additional allowable subject matter.

New Claims

New independent Claim 33 is directed to a method for bonding base materials using localized millimeter wave energy including applying a joining material to coat each surface of the base materials being joined disposing each said base material such that the coated surfaces of the base materials being joined are in contact, heating said joint area with a millimeter wave beam to an initial joining temperature, heating said joint area with a millimeter wave beam to a reactive temperature of the joining material and the base materials, and maintaining said joint area at said reactive temperature for a predetermined period.

The combination of features set forth in Claim 33 is believed to be allowable over the cited reference, either singly or in combination.

Dependent Claims 34-36 depend from Claim 33 and set forth additional features believed

to be allowable over the cited references. Claim 34 recites cooling said joint area to a recrystallization temperature, maintaining said joint area at the recrystallization temperature for a predetermined period, and cooling said joint area to room temperature. Claim 35 recites that the millimeter wave beam is generated by a gyrotron. Claim 36 sets forth that said heating said joint area to the reactive temperature of the joining material and the base materials comprises heating at a rate of at least 50 degrees C per minute.

New Claims 21 - 32 depend from Claim 1 and set forth additional features believed to be allowable over the cited references. Claim 21 sets forth that the method includes transmitting the beam through optics toward the joint area. Claim 22 recites that the beam has a diameter of at most five centimeters. Claim 23 recites that the beam has a diameter of between four and five centimeters. Claim 24 recites that the beam has a spot size of one centimeter. Claim 25 recites that the localized heating is limited to an area with a diameter of two to five centimeters. Claim 26 recites the feature of maintaining said joint area at the initial joining temperature for a predetermined period. Claim 27 recites that the initial joining temperature is about 1200 degrees C. Claim 28 sets forth that said rapidly heating said joint area to the reactive temperature of the joining material and the base materials comprises heating at a rate of at least 50 degrees C per minute. Claim 29 recites that the short interval is about five minutes. Claim 30 recites that the joining material is chemically reactive with alumina at 900 degrees C. Claim 31 recites that the base material is alumina. Claim 32 recites that the joining material is a glass frit comprising calcium oxide.

Claim 37 depends from Claim 4 and recites that the low temperature fixtures comprise at

least one of a steel and a boron nitride ceramic.

Examination and allowance of new claims 19-37 is requested.

Conclusion

The application is believed to be in condition for allowance. An early indication of the allowability of the application is respectfully requested.

The Commissioner is authorized to charge any fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-0281.

Should there be any questions regarding this Amendment, or the application in general, the Examiner is cordially invited to contact the undersigned at the number listed below.


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April 18, 2005